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ABSTRACT

This index was developed to help air conditioning and refrigeration instructors in Missouri use existing instructional materials and keep track of student progress on the VAMS system. The list was compiled by a committee of instructors who selected appropriate references and identified areas that pertained to Missouri competencies. The index lists competencies in these 11 areas: safety; basic refrigeration; tubing and connections; basic electricity; controls; domestic refrigeration; commercial refrigeration; residential/light commercial cooling/heating; diagnosing and problem solving; fundamentals of air conditioning; and customer sales and relations. Each competency is then listed in a matrix that identifies where it appears in one or more of the 15 texts selected to be used in the course. (KC)

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COMPETENCY INDEX

for Air Conditioning and Refrigeration programs in Missouri

A crosswalk of selected instructional materials against

Missouri's competency profile

Instructional Materials Laboratory
University of Missouri-Columbia

June 1990

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
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ABOUT THE PROJECT

This project should help AC/refrigeration instructors use existing curriculum materials and keep track of student progress on the VAMS system. A committee of eight instructors selected appropriate references and identified areas that pertained to Missouri competencies.

Instructors using the MAVCC Air Conditioning series should take note of the various revisions. For example:

*Book I (1977) was revised into the 1984 Fundamentals.
*Book II (1977) was split into the 1983 Domestic Refrigeration and the 1984 Electrical Components and Systems.
*The 1980 Book III and 1981 Book IV have been combined into the 1990 Residential and Light Commercial HVAC.
*Residential Wiring, originally published in 1983, was updated in 1988.

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KEY TO REFERENCES USED FOR CROSSWALK

Modern Refrig. & AC, 1988 (Goodh.-Willcox)	Althouse, Andrew D.; Carl H. Turnquist; Alfred F. Bracciano. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc., 1988.
MAVCC Air Conditioning series (publisher:	**Mid-America Vocational Curriculum Consortium, Stillwater, Oklahoma)**
Book I ('77)	Wantiez, Gary W. Air Conditioning and Refrigeration Book I. 1977.
Book II ('77)	Wantiez, Gary W. Air Conditioning and Refrigeration Book II. 1977.
Book III ('81)	Eckes, William, and Dan Fulkerson. Air Conditioning and Refrigeration Book III. 1981.
Book IV ('81)	Eckes, William, and Dan Fulkerson. Air Conditioning and Refrigeration Book IV. 1981.
Fund. ('84)	Wantiez, Gary W. Air Conditioning and Refrigeration Fundamentals. 1984.
Res. & Lt. Com. ('90)	Stephenson, David. Residential and Light Commercial HVAC. 1990.
Domestic ('83)	Wantiez, Gary W. Domestic Refrigeration. 1983.
Electrical ('84)	Wantiez, Gary W. Electrical Components and Systems. 1984.
Residential Wiring ('83)	Taylor, Mark. Residential Wiring. 1983.
Residential Wiring ('88)	Taylor, Mark; Don Blasingame; Gary Flowers. Residential Wiring. 1988.
Refrig. & AC Tech., 1987	Whitman, William C., and William M. Johnson. Refrigeration and Air Conditioning Technology. Albany, NY: Delmar Publishers Inc., 1987.
Hayden Bks.	Van Valkenburgh, Nooger & Neville, Inc. Basic Electricity. Indianapolis, IN: Hayden Books, a division of Howard W. Sams & Co., 1978. 12th printing, 1989.
McGraw-Hill	Adams, James E., and Gordon Rockmaker. Industrial Electricity Principles and Practices. 3rd ed. New York: McGraw-Hill Book Co., 1985.
IML Special Needs, 1988	Winston, Del; Ray Norris; Jim Wilde. Supplementary Units for Air Conditioning and Refrigeration. University of Missouri-Columbia: Instructional Materials Laboratory, 1988.

COMPETENCY LIST

A. Safety

1. Identify types, purposes, and operation of fire extinguishers
2. Inspect shop for hazards
3. Work cautiously and safely
4. Demonstrate removal procedures from an electrical conductor
5. Demonstrate knowledge of safe refrigerant handling

B. Basic Refrigeration

1. Identify principles of refrigeration
2. Use high and low manifold gauge
3. Leak-test and evacuate system
4. Identify sealed system components
5. Identify sealed system accessories
6. Resolve high and low suction discharge pressure problems
7. Test temperatures

C. Tubing and Connections

1. Identify different types of tubing and fittings
2. Demonstrate safety procedures and precautions
3. Install, repair and replace copper tubing
4. Install, repair and replace aluminum tubing
5. Install and replace plastic tubing and pipe
6. Braze tubing
7. Identify and use related tools and instruments
8. Use tools and instruments safely

D. Basic Electricity

1. Demonstrate safety procedures and precautions
2. Describe the major concepts of electrical theory
3. Identify and use test equipment
4. Interpret electrical diagrams
5. Troubleshoot complete electrical circuit
6. Test capacitors
7. Install circuit wiring to local code
8. Describe the major concepts of electric motor theory
9. Test electrical components

E. Controls

1. Demonstrate safety procedures and precautions
2. Describe concept of control theory and application
3. Install, replace and adjust electrical controls
4. Install and replace temperature pressure control
5. Adjust temperature pressure control
6. Install and replace solid-state control
7. Replace, calibrate and adjust temperature control
8. Install, repair, replace and adjust time control
9. Install and replace water regulating valve
10. Adjust water regulating valve
11. Install and replace oil pressure safety control
12. Install and replace pneumatic controls
13. Install, replace, and repair magnetic starter and components
14. Install and replace current relay
15. Install and replace potential relay
16. Install and replace control relay
17. Install and replace transformer
18. Describe concept of programmable thermostats
19. Identify the components of a four-way reversing valve

F. Domestic Refrigeration

1. Demonstrate safety procedures and precautions
2. Test compressor efficiency
3. Install and replace compressor
4. Install and replace access valve
5. Repair and replace condensor
6. Repair and replace evaporator
7. Repair and replace metering devices
8. Replace components of defrost system

9. Replace temperature controls
10. Replace motor control devices
11. Replace heaters
12. Perform cleanup of a contaminated system
13. Charge refrigeration system
14. Perform preventative maintenance
15. Interpret wiring diagram - refrigerator
16. Check and adjust air flow
17. Identify and use related tools and instruments

G. Commercial Refrigeration

1. Test compressor efficiency
2. Install, replace and repair compressor
3. Install and replace condensing unit
4. Install, repair and replace stem-type valve
5. Install, replace and test control valves
6. Repair and replace condensor
7. Repair and replace evaporator
8. Replace and repair metering device
9. Adjust metering device
10. Replace defrost system components
11. Replace heaters
12. Perform cleanup of a contaminated system
13. Charge refrigeration system
14. Check and adjust air flow
15. Identify and use related tools and instruments
16. Pump down unit
17. Perform preventative maintenance
18. Interpret wiring diagram

H. Residential/Light Commercial Cooling/Heating

1. Demonstrate safety procedures and precautions
2. Test compressor efficiency
3. Install and replace compressor
4. Install and replace condensing unit
5. Repair and replace condensor
6. Repair and replace evaporator
7. Install, replace and test control valves
8. Replace and repair metering devices
9. Adjust metering device
10. Perform cleanup of a contaminated system
11. Charge air conditioning system
12. Check capacity of cooling system
13. Interpret wiring diagram - cooling system
14. Describe operation of a heat pump
15. Interpret wiring diagram - heat pump
16. Check capacity of heat pump
17. Replace defrost system components - heat pump
18. Start and check a residential heating and cooling system
19. Describe concept of balance points
20. Identify and describe operation of heating system components
21. Interpret wiring diagrams - heating systems
22. Start and adjust a furnace
23. Check and adjust air flow
24. Install and replace electric motor
25. Repair, replace and service electronic air cleaner
26. Perform preventative maintenance
27. Pump down unit
28. Remove and replace drier cartridge
29. Clean, repair and maintain cooling tower
30. Identify and use related tools and instruments

I. Diagnosing and Problem Solving

1. Perform systematic problem solving of an air system
2. Perform systematic problem solving of an electrical system
3. Perform systematic problem solving of a fuel system
4. Perform systematic problem solving of a refrigerant system

J. Fundamentals of Air Conditioning

1. Interpret psychrometric chart
2. Solve psychrometric problems
3. Measure air qualities; i.e., dry bulb, wet bulb, CFM
4. Describe concept of air treatment
5. Describe concept of heat loss and heat gain factors
6. Identify and use related tools and instruments

K. Customer Sales and Relations

1. Fill out service report

Competency	Book I ('77) II ('77) III ('81) IV ('81)	Fund. ('84)	Res. & Lt. Com. ('90)	Domestic ('83);	Electrical ('84)	Resid. Wiring ('83) ('88)
A1	I-Sec. B UII	IB VI-VIII				
A2	I-Sec. B UII	IB IV-V				
A3	I-Sec. B UII	IB III-IV				UII, IV
A4	I-Sec. B UII	IIB XIII				UIV, V
A5	I-Sec. B UII, I-Sec. F UIII	IIB IV, VII				
B1	I-Sec. F UII	IA I				
B2	I-Sec. F UIII	IIC III, VI				
B3	I-Sec. F UIV, Sec. G UI	IIC IV, F VII				
B4	I-Sec. B UII	IA V		UII-III		
B5	I-Sec. B UII	IIF II				
B6	I-Sec. G UII	IIF IX				
B7		IIC III				
C1	I-Sec. D UI	ID II, VII				
C2	I-Sec. D UII	IIV E				
C3	I-Sec. D UII, Sec. E UII and III	ID I-III				
C4	I-Sec. E UIV	ID II				
C5	I-Sec. D UIII	IID X-XI				
C6	I-Sec. E UIII	IE II-VII				
C7	I-Sec. C UI-III, Sec. D UII	ID and IE				
C8	I-Sec. D UII	IE				
D1	II-Sec. A UI-II				UII	('83) Sec. A, UIII ('88) UI-V
D2	II-Sec. A UI				UI-II	('83) Sec. C, UI-II

Competency	Book I ('77) II ('77) III ('81) IV ('81)	Fund. ('84)	Res. & Lt. Com. ('90)	Domestic ('83);	Electrical ('84)	Resid. Wiring ('83) ('88)
D3	II-Sec. A UII				UII	(83) Sec. B, UII
D4	II-Sec. D UI			UII, III, VIII	UXIII	('88) UI-V
D5	IV UI-IV					('88) UI-V
D6	II-Sec. A UII			UV-VIII	UVII	
D7	II-Sec. B UIV			UV	UIV	('88) UI-V
D8	II-Sec. C UI				UVIII-XII	
D9	II-Sec. A UII			UV-VIII	UII	
E1						
E2	II-Sec. B UI-III			UIII	UIV-VII	
E3	II-Sec. B UI-III			UIII	UIV-V	
E4	II-Sec. B UIII			UIII	UVI	
E5	II-Sec. B UIII			UIII	UVI	
E6	II-Sec. B UII-III				UVI	
E7	II-Sec. B UI				UIV	
E8	II-Sec. B UII				UIV	
E9						
E10						
E11	II-Sec. B UIII				UVI	
E12						
E13	II-Sec. C UIV				UV-VI	
E14	II-Sec. B UII			UV	UV	
E15	II-Sec. B UII				UV	
E16	II-Sec. B UII				UV	

Competency	Book I ('77) II ('77) III ('81) IV ('81)	Fund. ('84)	Res. & Lt. Com. ('90)	Domestic ('83);	Electrical ('84)	Resid. Wiring ('83) ('88)
E17	IV UI				UIII	
E18	IV UI				UIV	
E19	IV UIV					
F1	I-Sec. B UII					('88) UI-V
F2	II-Sec. E UII			UIII-IV		
F3	II-Sec. E UII			UII-III		
F4	I-Sec. F UII			UII-III		
F5				UII-IV		
F6	II-Sec. E UIV			UII-IV		
F7	II-Sec. E UII			UII-IV		
F8	II-Sec. E UIII			UII-IV		
F9	II-Sec. E UIII			UII-III		
F10	II-Sec. E UII			UII-III		
F11	II-Sec. E UIV			UIII		
F12	II-Sec. E UIV			UIII-IV		
F13	II-Sec. E UIV			UIV		
F14				UII-III		('88) UI-V
F15	II-Sec. E UV			UIII		('88) UI
F16						
F17	I-Sec. C UI-II					
G1	I-Sec. F UI					
G2	I-Sec. F UI					
G3	I-Sec. F UI					

Competency	Book I ('77) II ('77) III ('80) IV ('81)	Fund. ('84)	Res. & Lt. Com. ('90)	Domestic ('83)	Electrical ('84)	Resid. Wiring ('83) ('88)
G4	I-Sec. F UII					
G5	I-Sec. F UI					
G6	I-Sec. F UI					
G7	I-Sec. F UI					
G8	I-Sec. F UI					
G9	I-Sec. F UI					
G10						
G11						
G12	II-Sec. E UIV					
G13	I-Sec. G UII					
G14						
G15	I-Sec. C UI-II					
G16						
G17						
G18					UI, XIII	
H1						
H2						
H3	IV UIII					
H4	IV UIII					
H5	IV UIII					
H6						
H7						
H8	IV UIII					

Competency	Book I ('77) II ('77) III ('80) IV ('81)	Fund. ('84)	Res. & Lt. Com. ('90)	Domestic ('83)	Electrical ('84)	Resid. Wiring ('83) ('88)
H9	IV UIII					
H10						
H11	IV UIII					
H12						
H13	IV UIII			UVII	UXIII	
H14	IV UIV					
H15	IV UIV				UXIII	
H16						
H17	IV UIV					
H18	IV UIII			UVII-VIII		
H19	IV UV					
H20	IV UI-II					
H21	IV UI-II				UXIII	
H22	IV UI-II					
H23	IV UI-II					
H24	IV UI-II					
H25	IV UI-II					
H26	IV UI-II					('88) UI-V
H27						
H28	IV UIII					
H29						
H30						
I1	III UVII					

Competency	Book I ('77) II ('77) III ('80) IV ('81)	Fund. ('84)	Res. & Lt. Com. ('90)	Domestic ('83)	Electrical ('84)	Resid. Wiring ('83) ('88)
I2	IV UI-IV					('88) UI-V
I3	IV UI					
I4	IV UIII					
J1	III UV					
J2						
J3	III UV					
J4	III UVIII					
J5	III UVI					
J6						
K1	III UIV					

Competency	Modern Refr. & AC, 1988 (Goodh.-Willcox)	Refrig. & AC Tech., 1987 (Delmar)	Hayden Books	McGraw-Hill	IML Special Needs, '88	Other
A1		U10.3			U1	
A2		U10			U1	
A3		U7.1, 7.10, 10.5			U1	
A4		U10.2				
A5	9-37	U10.1			U1	
B1	Ch. 1-2	U3.4				
B2	11-27, 28	U8.1, 8.4, 9.4			U6, 7, 10	
B3	11-38 thru 11-43, 11-75	U9.6			U9-10	
B4	Ch. 3-4	U9.4				
B5	11-54, 12-5, 14-74, 14-75	U23.33, 23.38				
B6	11-17, 18	U16.1, 17.2, 25.12, 25.13			U7 and 10	
B7	Ch. 1-7	U14.1, 14.4				
C1	Ch. 2	U6.1-6.3, 6.11-6.13				
C2	Ch. 2	U6.1, 6.13				
C3	Ch. 2	U6.9, 6.10				
C4	Ch. 2					
C5	Ch. 2	U6.17				
C6	2-20	U6.10				
C7	2-30 to 2-68	U6.10-6.17				
C8		U6.13, 6.16				
D1	Ch. 6	U11.11, 11.19, 11.21, 16.4			U1, 7, 8	
D2	Ch. 6	U11.1-11.9	1-1 to 1-28		U2	
D3	Ch. 6	U11.10, 11.11, 11.19	1-83 to 1-113	22-1	U2, 7, 8	

Competency	Modern Refr. & AC, 1988 (Goodh.-Willcox)	Refrig. & AC Tech., 1987 (Delmar)	Hayden Books	McGraw-Hill	IML Special Needs, '88	Other
D4	8-2	U13.3, 16.4-16.8	2-32 to 2-111		U5, 8, 9	
D5		U17.5, 18.11, 43.25, 43.26, 45.39	2-137 to 2-143		U5, 7, 8	
D6	11-30	U29.11, 29.12, 11.18		15-15	U4-5	
D7	28-33	U28.10		19-16		
D8	6-48	U11.15, 11.16, 26.3-26.6		15-14	U3-4	
D9	8-25 thru 8-30	U26.17-26.19			U3-5, 8	
E1	8-43	U11.11, 11.19, 11.21, 16.4				
E2	8-4	U12.1-12.6, 41.3		17-1 to 17-10	U3	
E3	8-11 thru 8-16, 8-22	U41.8-41.12			U3, 5, 6	
E4	8-22	U13.2-13.4				
E5	8-22, 8-39	U13.4				
E6	8-29	U22.20				
E7	8-14	U12.1-12.3, 16.4				
E8	8-37	U18.5-18.11				
E9	14-59 thru 14-61	U15.7, 15.8, 17.2-17.5				
E10	14-61	U17.2				
E11	12-40	U11.17				
E12	25-36, 37	U36.7-36.10				
E13	6-79, 12-41	U28.5, 28.6, 28.8, 28.11-28.13			U3	
E14	8-25, 26	U26.19, 26.20			U3, 5	
E15	8-25 thru 8-27	U26.18			U3	
E16	25-20 thru 25-22	U28.3-28.5			U3	

Competency	Modern Refr. & AC, 1988 (Goodh.-Willcox)	Refrig. & AC Tech., 1987 (Delmar)	Hayden Books	McGraw-Hill	IML Special Needs, '88	Other
E17	6-75 thru 6-78	U11.17			U3	
E18	25-14, fig. 25.41	U11.15, 11.16				
E19		U45.1-45.5				
F1	11-83	U3.5				
F2	4-54, 15-47, 15-48, 14-41	U21.7-21.9			U6	
F3	11-46, 50, 58, 61	U21.1-21.3				
F4	11-29, 33	U4.3				
F5	11-45, 46, 50, 62	U20.1-20.7				
F6	11-45, 46, 50, 63	U19.10				
F7	11-50, 52, 64	U3.10-3.11				
F8	10-10, 10-14, 11-55	U19.19, 23.23			U5, 8	
F9		U13.2-13.4				
F10	11-21	U28.1-28.5			U3-5	
F11	10-21	U45.33-45.36			U5, 8	
F12	11-59, 60	U7.5-7.7				
F13	11-46, 47	U8.1-8.5			U10	
F14	14-80, 81, 100				U11	
F15	8-2; 10-9, 13, 17, 20, 21				U5, 7, 8	
F16	15-16, 18, 19	U39.21, 39.23				
F17	Ch. 2	U4				
G1	4-54, 14-41, 15-47, 15-48	U21.7-21.9				
G2	14-35, 7	U21.1-21.3				
G3	14-45, 7, 3, 15	U40.21				

Competency	Modern Refrig. & AC, 1988 (Goodh.-Willcox)	Refrig. & AC Tech., 1987 (Delmar)	Hayden Books	McGraw-Hill	IML Special Needs, 1988	Other
G4	14-34	U4.3				
G5		U20.10, 34.24				
G6	14-45, 14-47, 14-48, 15-54	U20.1-20.7				
G7	14-62 thru 14-65, 4, 16	U19.10				
G8	14-66, 14-70 thru 14-72	U3.10-3.11				
G9	14-67, 68, 72, 73	U22.18, 22.21				
G10	14-76, 95; 15-38	U45.33-45.35, 23.23-23.29				
G11	3-24, 10-15, 12-32	U23.23-23.29, SC22, fig. 25-60				
G12	14-82, 10	U7.5-7.7				
G13	14-83, 10, 12	U8.1-8.5				
G14	15-16, 18, 19	U39.21-39.23				
G15		U4			U11	
G16	14-32, 15-57	U23.31, 23.32			U10	
G17	14-81, 80, 100	U20.4, 20.5				
G18	8-2, 14-85	Fig. 18-1A, 18-7, 18-8, 18-15, 18-16			U8-9	
H1	12-76, 14-109	U10				
H2	4-54, 14-41, 15-47, 15-48	U21.7-21.9			U6	
H3	11-61, 11-70, 11-71	U21.1-21.3				
H4	14-3, 14-15, 14-35, 23-32	U40.21				
H5	14-44 thru 14-49	U20.1-20.7				
H6	14-4, 14-16, 14-20, 14-62, 14-63, 15-15	U19.10				

Competency	Modern Refrig. & AC, 1988 (Goodh.-Willcox)	Refrig. & AC Tech., 1987 (Delmar)	Hayden Books	McGraw-Hill	IML Special Needs, 1988	Other
H7	12-56 thru 12-60, 12-64, 12-65	U20.10, 34.24				
H8	11-46, 14-66, 14-69 thru 14-72	U3.10, 3.11				
H9	11-46, 14-67, 14-69 thru 14-72	U22.18, 22.21				
H10	11-60	U7.5-7.7				
H11	11-27, 11-47, 14-2	U40.29, 40.34, 40.36			U9-10	
H12	15-13, 15-14, 15-20, 15-47	U42.2-42.5			U9	
H13	8-2, 8-27	Fig. 41-9, 41-13			U9	
H14	23-1 thru 23-3	U45				
H15	8-2, 8-27	U45				
H16	23-4, 23-6	U45				
H17	23-9, 23-15	U45				
H18	14-13, 14-15, 19-11, 23-30 thru 23-34, 25-7, 25-8, 25-10, 25-26	U40.29, 40.34, 40.36			U9	
H19	23-22	U39.24, 39.26, fig. 39-55				
H20		Sec. 6				
H21	8-2, 8-27, 23-9	Fig. 30-10, 30-14 thru 30-21				
H22	20-17 thru 20-21, 20-24, 20-26, 20-38	U31.34, 31.35				
H23	22-13 thru 22-15, 22-20, 22-21, 22-24, 22-45, 22-46	Fig. 39-55				
H24	14-87 thru 14-89	U29.6-29.10			U4	
H25	22-32, 22-33					
H26					U9	
H27	11-76, 12-32, 14-10	U23.31, 23.32			U10	
H28	12-72, 12-73	U23.33				

Competency	Modern Refrig. & AC, 1988 (Goodh.-Willcox)	Refrig. & AC Tech., 1987 (Delmar)	Hayden Books	McGraw-Hill	IML Special Needs, 1988	Other
H29	12-13, 12-14, 14-53	U20.11-20.14				
H30	2-11, 2-12, 2-14, 2-16, 2-25, 2-30, 2-31, 2-40, 2-53, 2-55, 2-57, 2-58	U4				
I1	Pg. 922	U39			U7	
I2	11-14; pg. 352 and 556	Fig. 43-25			U7-9	
I3	Pg. 894	U44				
I4	11-12 thru 11-14; pg. 348-349	U25			U7	
J1	18-4 thru 18-9	Fig. 37-35A thru 37-35G				
J2	18-14 thru 18-16	U37.5, 37.11				
J3	18-18 thru 18-21	Fig. 37-25B, C and G				
J4	18-36 thru 18-41	U37.12				
J5	15-1 thru 15-12, 25-1 thru 25-21	U38.2, appendix 1				
J6	2-11 thru 2-65	U4, fig. 37-27				
K1						